Equations

```
Active Insurgent Retirement Rate=
               ACTIVE INSURGENTS/(avg insurgent career in months)
        Units: people/Month

ACTIVE INSURGENTS= INTEG (
        Increase in Insurgents-Insurgent Attrition Rate-Active Insurgent Retirement Rate
,
               initial active insurgents)
Units: people

Active Insurgents Fraction=
        xidz(ACTIVE INSURGENTS,Total Insurgents,1)
Units: dmnl
What fraction of the insurgents are active?

annual growth rate=
        0.03
Units: dmnl/year

attrition parameter=
        1
Units: dmnl

Attrition Rate from Suppression=
        Coercive Acts per Month*Effect of Insurgent Density*coercion fruitfulness
Units: people/Month
The fractional attrition rate from coercive acts.

avg insurgent career in months=
        avg insurgent career in years*months per year
Units: months

avg insurgent career in years=
        10
Units: years
The number of years an insurgent will be active assuming that he is
               not captured.

base british troops in Ireland=
        20000
Units: troops

base coercion fruitfulness=
        0.1
Units: people/act
This modifies how many insurgents will be captured per coercive act
               in the base case

base insurgent density=
        0.0005
Units: dmnl

base insurgent fraction= INITIAL(
        1000/Potential Insurgents)
Units: dmnl
This is the base fraction of the population that will be attracted to
               insurgent activities

base population=
        3e+006
Units: people

BRITISH TROOPS IN IRELAND=
        base british troops in Ireland*Ef on British Troops
Units: people
Note that this variable also includes the number of auxilliary troops
               used in the war such as the Royal Irish Constabulary.
```

```
BRITISH WAR WEARINESS=
        smoothi(PRESSURE TO REDUCE INCIDENTS*war weariness switch,time to weary of war,
0)
Units: dmnl
This is the desire of the British to pull out of Ireland due to
                weariness with the insurgency.

BRITISH WITHDRAWL FLAG= INTEG (
        Chg in Flag,
                0)
Units: dmnl
If flag is set, then the British have given up and withdrawn their
                troops from Ireland.

Chg in Flag=
        if then else((BRITISH WITHDRAWL FLAG=0) :AND: (BRITISH TROOPS IN IRELAND<min
british troops to hold Ireland
),1/TIME STEP, 0)
Units: dmnl/Month
This will set the BRITISH WITHDRAWL FLAG once British presence in
                Ireland (as measured by active troops) has fallen below a minimal
                threshold.

Chg in Satisfaction=
        (Indicated Irish Satisfaction with British Rule-IRISH SATISFACTION WITH BRITISH
RULE
)/if then else(Indicated Irish Satisfaction with British Rule>IRISH SATISFACTION WITH
BRITISH RULE
,time to satisfy,time to dissatisfy)
Units: dmnl/Month
This measures how quickly Irish satisfaction with British rule
                changes. Note that the time for satisfaction to decrease and to
                increase are different.

coercion fruitfulness=
        base coercion fruitfulness*Ef on Attrition Rate
Units: people/act
This modifies how many insurgents will be captured per coercive act
                in the base case

coercion parameter=
        0.5
Units: dmnl
This causes the coercive acts per British soldier to have diminishing
                returns to the "pressure to reduce incidents". It should be set to be
                less than one.

coercion response time=
        1
Units: months

coercive act per Irish citizen=
        Coercive Acts per Month/population
Units: acts/person/Month
How much is the average Irish citizen aware of coercive acts by the
                British Government?

Coercive Acts per British Soldier=
        smoothi(1-exp(-coercion parameter*PRESSURE TO REDUCE INCIDENTS),coercion response
time
,0)*max coercive acts
Units: acts/person/Month
Acts of house searching, detainment, etc. that may lead to arrest of
                an insurgent. It is an increasing function of the pressure to reduce
                incidents with diminishing returns. It also saturates at "max
                coercive acts"

Coercive Acts per Month=
        BRITISH TROOPS IN IRELAND*Coercive Acts per British Soldier*incident suppression
loop sw
```

```
Units: acts/Month
Total coercive acts by all British troops and paramilitaries in
               Ireland. Includes house searches, etc.

Ef of Weapons on Pressure=
       1-exp(-weapons availability*weapons parameter)
Units: dmnl
This is an increasing function with a max at one.

Ef on Attrition Rate=
       if then else( insurgent creation loop switch=1,IRISH SATISFACTION WITH BRITISH
RULE
^attrition parameter,1)*(1-BRITISH WITHDRAWL FLAG)
Units: dmnl
This is a multiplier that affects coercive fruitfulness depending on
               Irish satisfaction with British rule. If the Irish are highly
               dissatisfied, they will make it diffiucult for the British coercive
               acts to result in capturing an insurgent.

Ef on British Troops=
       smoothi(exp(-BRITISH WAR WEARINESS*troop parameter)*(1-BRITISH WITHDRAWL FLAG),
time to move troops, 1)
Units: dmnl
The wearier the British public is with the war, the less troops they
               maintain in Ireland. Once British Troops have completely pulled out,
               however, they never come back.

Ef on Insurgent Numbers=
       xidz(1,IRISH SATISFACTION WITH BRITISH RULE,1)^insurgent parameter*(1-BRITISH
WITHDRAWL FLAG
)
Units: dmnl
Effect of Irish Satisfaction (or lack thereof) on Irish insurgents

Effect of Insurgent Density=
       (ACTIVE INSURGENTS/base population)/base insurgent density
Units: dmnl
What is the effect of insurgent density on finding an insurgent

FINAL TIME  = 120
Units: Month
The final time for the simulation.

fraction of males liable to join insurgency= INITIAL(
       avg insurgent career in years/lifespan in years/2)
Units: dmnl
Males are half of population. We assume males between ages of 15 and
               30 will want to become insurgents.

fractional attrition rate per incident=
       0.01
Units: persons/incident
How many insurgents are captured/killled per incident.

Inactive Insurgent Retirement Rate=
       INACTIVE INSURGENTS/avg insurgent career in months
Units: people/Month
Lifespan of insurgents before "retiring" is assumed to be finite.

INACTIVE INSURGENTS= INTEG (
       Insurgent Attrition Rate-Inactive Insurgent Retirement Rate,
              0)
Units: people
The number of captured and dead insurgents who would have remained
               active if they had been able to.

incident suppression loop sw=
       1
Units: dmnl
0 = No Incident Suppression Loop; 1 = Incident Suppression Loop on
```

```
incidents per insurgent per month=
        0.01
Units: incidents/Month/person

Increase in Insurgents=
        max(if then else (Indicated Insurgents<Total Insurgents,1,Active Insurgents
Fraction
)*(Indicated Insurgents-Total Insurgents
        )/time to join insurgency,
        -ACTIVE INSURGENTS/minimum demobilization time for insurgents)*insurgent creation
loop switch
Units: people/Month
This drives the number of active insurgents to what their indicated
                level should be based on Irish satisfaction with British Rule.
                However, there is also a maximum rate at which they leave to prevent
                the active insurgent stock from going negative. This would represent
                the tendency of some fraction of the insurgents to be extremely hard
                line.

Indicated Insurgents=
        base insurgent fraction*potential insurgent fraction activated*Potential
Insurgents
Units: people
This is how many insurgents there could be if they could immediately
                "join up" and pick up arms.

Indicated Irish Satisfaction with British Rule=
        min(xidz(1,(coercive act per Irish citizen/ref coercions per Irish
citizen)^satisfaction parameter
,1),1)
Units: dmnl
This is how satisfied the Irish would be with British rule absent any
                legacy effects. It's primarily determined by the British interference
                in Irish Civil life through coercive acts.

initial active insurgents=
        1000
Units: people

INITIAL TIME  = 0
Units: Month
The initial time for the simulation.

Insurgent Attrition Rate=
        Insurgent Incidents*fractional attrition rate per incident+Attrition Rate from
Suppression
Units: people/Month
Number of insurgents detained, killed, or going "AWOL" per month.

insurgent creation loop switch=
        1
Units: dmnl
0 = Loop Off; 1 = Loop On

Insurgent Incidents=
        ACTIVE INSURGENTS*incidents per insurgent per month
Units: incidents/Month
How many raids, snipings, bombings etc. are committed in total by all
                insurgents

insurgent parameter=
        2.5
Units: dmnl
Power that modifies the effect of Irish Satisfaction with British
                rule on Insurgent numbers. This power should be greater than 1.

IRISH SATISFACTION WITH BRITISH RULE= INTEG (
        Chg in Satisfaction,
                1)
Units: dmnl
This is an index of how satisfied the Irish are with British rule.
```

Note that there is a first-order delay between the indicated satisfaction as a function of current British coercive acts and the change in perceptions by the Irish people.

lifespan in years=
50
Units: years

max coercive acts=
0.2
Units: acts/person/Month
This is a limit on how many coercive acts a British soldier could commit per month

min british troops to hold Ireland=
2000
Units: troops

minimum demobilization time for insurgents=
6
Units: months

minimum insurgent fraction activated=
0.1
Units: dmnl
There are always some discontents in most societies

months per year=
12
Units: months/year

population=
base population*(1+annual growth rate/12)^Time
Units: people
The base population increases with time

potential insurgent fraction activated=
minimum insurgent fraction activated+Ef on Insurgent Numbers
Units: dmnl
What fraction of potential insurgents actually want to take up arms

Potential Insurgents=
fraction of males liable to join insurgency*population
Units: people
Number of population who could be converted to insurgents if the conditions are right.

PRESSURE TO REDUCE INCIDENTS=
Insurgent Incidents*Ef of Weapons on Pressure/ref incidents
Units: dmnl
This is the effect of incidents on the urgency felt by British govt. to do something about it. The effect of this will be lagged in its outcomes.

ref coercions per Irish citizen=
0.0001
Units: acts/Month/person
Scaling factor for Irish Satisfaction

ref incidents=
5
Units: incidents/Month
Scaling factor for impact of incidents on pressure on the British Govt.

satisfaction parameter=
0.5
Units: dmnl
This should be set to less than one to ensure diminishing returns to coercive acts

SAVEPER =
        TIME STEP
Units: Month
The frequency with which output is stored.

TIME STEP = 0.25
Units: Month
The time step for the simulation.

time to dissatisfy=
        3
Units: Month
Time needed to upset the Irish

time to join insurgency=
        6
Units: Month

time to move troops=
        6
Units: months

time to satisfy=
        60
Units: months

time to weary of war=
        24
Units: months

Total Insurgents=
        ACTIVE INSURGENTS+INACTIVE INSURGENTS
Units: people

troop parameter=
        0.75
Units: dmnl
Should be set to less than one to ensure diminishing returns

war weariness switch=
        1
Units: dmnl
0 = War Weariness Loop Off; 1= War Weariness Loop On

weapons availability=
        1
Units: dmnl
This is an variable that accounts for fact that if the insurgents are
                armed, it generally escalate the impact of any incidents.

weapons parameter=
        5
Units: dmnl
Availability of weapons rapidly escalates the effect of any incident